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Research of parasites with zoonotic potential for humans in skipjack tuna (*Katsuwonus pelamis*)

Pesquisa de parasitos com potencial zoonótico para humanos em bonito-listrado (Katsuwonus pelamis)

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The skipjack tuna (*Katsuwonus pelamis*) is commonly found in the tropical waters of the oceans. It is a fishing resource of high economic value and available for national and international markets. Therefore, it is important to know the fish parasites for a correct sanitary inspection, as the pathogenesis in humans can occur through spoliative, toxic or mechanical action. This study aimed to identify the zoonotic parasitic fauna that infects the beautiful-striped using morphological methods. A total of 06 samples were analyzed. The fish were necropsied for parasitological evaluation of the musculature and internal organs. The samples were visually inspected and the structures with morphology combining with parasitic shapes were analyzedboth in stereoscopic and microscope. The parasites found were fixed in 70% alcohol for later identification.All samples showed the presence of zoonotic parasites for humans. Two genera of zoonotic parasites have been found for humans that have beautiful tuna as their hosts, namely *Anisakis* sp. (Nematoda) and Trypanorhyncha (Eucestoda). A 100% of the infections occurred in the muscles and 66.6% in the liver. The results reinforced the importance of inspection by responsible organisms on the importance of evisceration as quickly as possible to avoid migration of larvae to the muscle.
Key-words: fish, anisakid, Trypanorhyncha.

O bonito-listrado (*Katsuwonus pelamis*) é comumente encontrado nas águas tropicais dos oceanos. É um recurso pesqueiro de alto valor econômico e disponível para os mercados nacional e internacional. Sendo assim, é importante o conhecimento dos parasitos de peixes para uma inspeção sanitária correta, pois a patogenia em seres humanos pode ocorrer por ação espoliativa, tóxica ou mecânica. Este estudo teve como objetivo identificar a fauna parasitária zoonótica que infecta o bonito-listrado utilizando métodos morfológicos. Foram analisadas um total de 06 amostras. Os peixes foram necropsiados para avaliação parasitológica da musculatura e nos órgãos internos. As amostras foram inspecionadas visualmente e as estruturas com morfologia combinante com formas parasitárias foram analisadas tanto em estereoscópico quanto em microscópio. Os parasitos encontrados foram fixados em álcool 70% para identificaçãoposterior. Todas as amostras apresentaram presença de parasitos zoonóticos para humanos. Foram encontrados dois gêneros de parasitos zoonóticos para os seres humanos que tem o atum bonito como hospedeiro, sendo eles *Anisakis* sp. (Nematoda) e Trypanorhyncha (Eucestoda). Observou-se que 100% das infecções ocorreram nos músculos e 66,6% no fígado. Os resultados reforçaram a importância da fiscalização pelos órgãos responsáveis sobre a importância de evisceração o mais rápido possível para evitarmigração das larvas para a musculatura.
Palavras-chave: pescado, anisaquideo, Trypanorhyncha.

1. INTRODUCTION

There is an increase in the number of people who prefer to consume fish meat as a healthy food alternative, in relation to other meats. The low fat content of many fish species, the excellent nutritional value due to their proteins, vitamins and the effects of polyunsaturated fatty acids found in the species are important aspects for those who are concerned about health, in particular in developed countries where mortality from cardiovascular disease is high [1-4].

The presence of parasites in fish is a concern for sanitary surveillance with zoonotic potential, causing consumer rejection and the animals must be eliminated by sanitary surveillance that constitutes consequent economic losses.

In this regard, the regulation of the industrial and sanitary inspection of animal products, RIISPOA defines as unfit for consumption fish that have muscle infestation by parasites that may or may not harm the consumer's health [5]. Acute gastric infection is one of the infection risks caused by the consumption of live parasite larvae [6-8]. Zoonoses occur when infected raw marine products are consumed by humans as accidental hosts [4, 9].

The sckipjack tuna (*Katsuwonus pelamis*) is a large pelagic fish commonly found in tropical ocean waters. [10, 11]. It is a fishery resource of high economic value and available for national and international markets. All carnivorous fish with pelagic habits are likely to be infected by anisakid nematodes. As this fish is part of the human diet, information about possible infections is crucial. Studies to identify the zoonotic parasites found must be carried out in order to identify and understand the form of action in the human body.

The results are beneficial for basic information from epidemiological studies, food safety and biological markers. In relation to food safety, identification is a basis for the study of potential pathogenic hazards and risks that can lead to a negative impact on human health.

Therefore, it is important to know the fish parasites for a correct sanitary inspection, as the pathogenesis in humans can occur by spoilage, toxic or mechanical action [12]. This study aimed to identify the zoonotic parasitic fauna that infects the striped bonito (*Katsuwonus pelamis*) using morphological methods.

2. MATERIAL AND METHODS

2.1 Sample collection

Specimens of skipjack tuna (*Katsuwonus pelamis*) were obtained through donation by the company Gomes da Costa LTDA, Itajaí, Santa Catarina, Southern Brazil. A total of six fish were packed in isothermal boxes and transported to the AQUOS-Aquatic Organisms Health Laboratory, at the Federal University of Santa Catarina (UFSC), where they were kept refrigerated until the necropsy.

2.2 Analysis of samples

In the laboratory, the fish were necropsied for parasitological evaluation of the musculature and internal organs. For this, the eyes, gills, gastrointestinal tract and viscera were removed and examined for collection of endoparasites.

Evisceration was performed from a ventral longitudinal section, from the anus to the cephalic region. To investigate the parasitism in the meat, two longitudinal cuts were made, on both sides, starting from the insertion of the tail towards the head until the level of the operculum, obtaining two fillets per fish.

The samples were visually inspected and structures with morphology combining with parasitic forms were analysed both in stereoscopic and under a microscope. The parasites found were fixed in 70% alcohol for later identification. The methods used for the collection and parasites identification followed Eiras et al. (2006) [13]. The morphological identification at the genus level of the parasites found was according to Campbell and Beveridge (1994) [14] for Trypanorhyncha and Castellanos et al. (2017) [15] for Anisakid nematodes. Morphological identification of the parasites was made using an Axio Imager A.2 differential interference contrast microscope (DIC, Zeiss, Gottingen, Germany).

3. RESULTS AND DISCUSSION

A total of six samples were analyzed, all of which showed the presence of zoonotic parasites for humans. Nematode parasites identified as the genus *Anisakis* sp. and cestodes Trypanorhyncha were observed being the last the most prevalent group. The results obtained were described in Table 1.

Table 1: Occurrence of parasites with zoonotic potential in sckipjack tuna (Katsuwonus pelamis)

Parasitized organs	N	N.I.	Parasite	P(%)	MI	MA	TNP
Muscle	6	6	*Trypanorhyncha*	100	20.5	20.5	123
Liver	6	4	*Anisakis*	66.6	5.0	3.33	20

Number of samples collected (N); Number of infected hosts (N.I.); Infection prevalence (P%); Medium intensity (MI); Mean abundance (MA); Total number of parasites (TNP).

The results showed that 100% of the infections occurred in the muscle and 66.6% in the viscera (liver) of the analysed fish (Figures 1, 2 and 3). This highlights the importance of evisceration being carried out as quickly as possible, thus preventing the parasites from migrating to the fish's muscle tissue [16, 17]. The muscle was the most affected organ, with a total of 123 parasites in 6 samples.

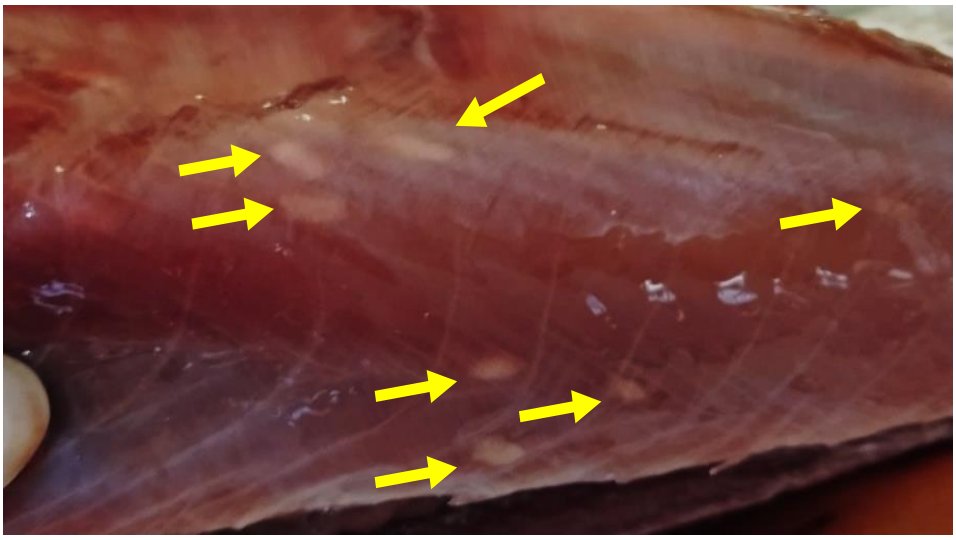

Figure 1: Trypanorhyncha parasitizing muscle of skipjack tuna.

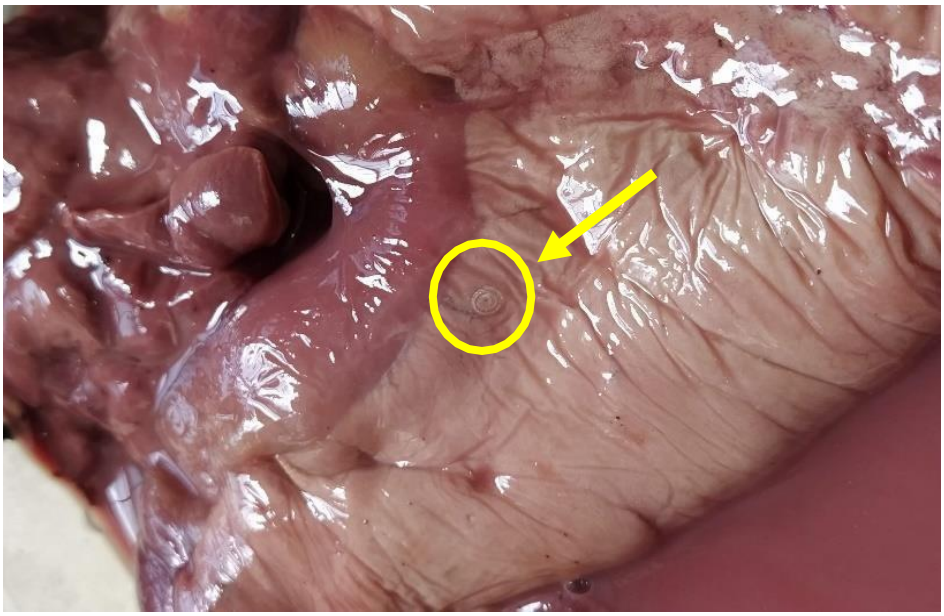

Figure 2: Anisakis sp. parasitizing liver of skipjack tuna.

Figure 3: Anisakis sp. observed under an optical microscope.

As for the parasites found, *Anisakis* sp. was the most reported in the literature when compared with Trypanorhyncha. Studies on allergic manifestations to fish parasite antigens are quite frequent, especially involving anisakids. However, only a few investigations have been carried out on this potential in other parasites, such as cestodes Trypanorhyncha.

The Trypanorhynca is the most common cestode parasitizing sharks and stingrays (definitive hosts in its adult form), as well as numerous invertebrates and teleost fish that can act as intermediate hosts (larvae forms - metacestoids), being it of worldwide occurrence [14, 18]. Accidental human infection by Trypanorhyncha larvae is rare. However studies that have pointed out the allergenic potential of some species of the group [19-24]. Each year, new genera and species of Trypanorhyncha are described. Until 2012, 290 species were registered [23]. The presence of Trypanorhyncha larvae in fish, mainly in the muscular tissue (with greater commercial value), has for many years led to economic losses due to the health aspect.

Sattari et al. (2014) [25] reported the presence of Trypanorhyncha metacestoids in sckipjack tuna obtained in the coast of Oman, in the Arabian Peninsula. Amato et al. (1990) [26] in a study identified the presence of *Tentacularia coryphaenae* in sckipjack tuna.

It is known that marine nematodes of the Anisakidae family are harmful to human health, as they can cause zoonosis such as anisakiasis [8, 27-32]. Zoonosis occur when infected raw marine products are consumed by humans as accidental hosts [30].

Both living and dead anisakids can cause allergic reactions, sometimes with serious consequences, including anaphylactic shock [30, 33]. Several species of fish-borne nematodes are recognized as causative agents of human disease. The Anisakidae family harbour human zoonotic genera like *Anisakis* spp., *Pseudoterranova* spp., *Contracaecum* spp. and *Hysterothylacium* spp. Among fish-borne nematodes, the most common species that cause human infections are *Anisakis spp.*,*Pseudoterranova* spp. and *Gnathostoma* spp., distributed worldwide [34-38].

In Brazil, little is known on the human infections by fish-borne nematodes. Some studies have discussed this issue pointing out the possible risk of eating raw or undercooked fish, or even dry or salty fish containing dead nematodes [30, 31, 32, 39-45].

Few articles reported human infections by fish-borne nematodes [43, 46-51]. However, the greater the number of fish species infected, especially in the case of economically important species, the greater the risk to humans of ingesting fish-infected nematodes.

4. CONCLUSION

Two genera of zoonotic parasites were found for human and skipjack tuna showed to be the host for *Anisakis* sp. and Trypanorhyncha. The first, in the viscera, highlighted the importance of

immediate evisceration soon after capture, while the second was found in the muscle of the fish examined, reinforcing the importance of inspection by government organisms prior to processing.

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